

# Food and Water Resources in Linamnutu Village: A Pilot Study

Technical report on field studies  
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Photo: Ibu Tomyko, UNDANA

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## 1. Introduction

This report presents the findings of a one week field trip in the village of Linamnutu, Timor Tengah Selatan (TTS), Nusa Tenggara Timur, Indonesia. This is a preliminary report, and is not an exhaustive analysis of the findings.

The field study had both research and educational purposes, and aimed to provide information about access and availability of food and water resources in Linamnutu Village (*Desa Linamnutu*) that is of interest, and use, to the village itself.

The work was generously supported by the village administration and residents of Linamnutu, who provided accommodation, meals and logistic support for the field team. The work was also kindly supported by *Badan Perencana Pembangunan Daerah* (BAPPEDA) TTS District (*Kabupaten*) Officers, So'E.

The field team comprised academic staff, researchers and students from two Indonesian universities - Universitas Kristen Satya Wacana (UKSW), Salatiga, and Universitas Nusa Cendana (UNDANA), Kupang, - and Charles Darwin University (Darwin), Australia.

In light of the successful education, research and community outcomes of the first field study in Linamnutu, the research team now hopes to continue to work with Linamnutu Village (*Desa Linamnutu*) for further field trips in 2011 and 2012.

### 1.1 Context for the field trip

#### Research opportunities

The research project was developed from partnerships among these three partner universities over more than a decade. The three universities have previous experience, and existing networks in Timor, and this study builds upon those.

One of our roles as researchers is to provide a forum in which access and availability issues for water and food resources in Linamnutu can be discussed and documented in a way that is useful for planning and prioritising for agency staff and the village community. Previous studies have uncovered ineffective use of irrigation infrastructure (Ancev 2009) due to inappropriate management. Local members of the research team also noticed that irrigation water was not being widely used to increase diversity in production (for example vegetable growing). This first field study comprised a fact-finding pilot study (similar to a Rapid Rural Appraisal), in order to identify issues of concern to the village community relating to water and food resources. These concerns will then be more systematically explored in subsequent field work.

The research project is also a research training activity for university students. The teaching and learning activities are linked with research activities, and so provide the students with a valuable opportunity to apply their learning to a real, multi-faceted research situation.

#### Reason for choosing to work at Linamnutu

Work with Linamnutu Village (*Desa Linamnutu*) is underpinned by a framework of long established relationships among village administration, the District (*Kabupaten*) Government, non-government organisations (NGOs) and universities which serve the area (including Charles Darwin University).

The presence of the dam (which replaced traditional water management for rice growing in the early 2000s) along with the naturally variable village topography, result in an ideal case study site in which to investigate the influence of a major dam project on household water resources.

### Development model

The project was developed within a framework of community engagement and community development, while its topic focus is on the management and use of natural resources (food and water). Specifically, it investigates food resources and water access, annual availability and quality within hamlets located in the uplands and lowlands of Linamnutu Village, west Timor, among people for whom poverty, poor health indicators and food and water shortages are annual realities.

Community development is addressed by including Village administration and District (*Kabupaten*) agencies as partners in the project. This will ensure research outcomes will be communicated directly to those in a position to implement recommendations.

Community capacity building is integrated into the project by including Village administration and District (*Kabupaten*) agencies in the framing of the research questions, during the course of the research engagement. Prior to each phase of field work, results of the previous field work are reviewed by the village community and District (*Kabupaten*) government staff, and the project methods and objectives modified as appropriate.

### Educational opportunities

The three partner universities, UKSW, UNDANA and CDU, have worked collaboratively to develop a field study intensive for third year undergraduate and Master students. The field activity for the unit is a research activity in Linamnutu Village, undertaken by the students under the supervision of staff from the partner universities. The field study is multi-disciplinary, designed to address development issues that affect livelihoods in a village community in NTT.

This model of teaching and learning in international higher education is innovative, because the development of the curriculum, teaching in the field and learning by students are collaborative among the Indonesian and Australian universities.

## **1.2 Issues facing NTT in general**

NTT is one of the poorest provinces in Indonesia. The majority (80%) of the population of NTT lives in rural areas and livelihoods are largely dependent on agriculture. Health in NTT is generally poor: high incidence of malaria, high infant mortality rate (54/1000 compared with 44/1000 nationally), and child mortality averaging 39% and reaching 50% in some areas (Muslimatun 2009).

Food availability is a challenge and famine is a frequent occurrence. Water is a major limitation to land productivity in west Timor, where there is an annual dry season of six to eight months (usually April to November). West Timor's soils are derived from marine sediments and are generally of low fertility. The topography is mountainous, with some peaks above 2000m. Annual rainfall varies with topography from over 1500mm in the highlands to less than 800mm in the coastal areas (Kieft 2001).

## **1.3 Objectives of this study**

This study aimed to interview village households in order to describe

- food resources and their availability
- water access and availability, including reference to the irrigation system associated with the dam

The research team aimed to document the circumstances experienced in the village and to thereby create a communication tool for the village community.

The objectives of this field activity related to education as well as research. The activity aimed to provide students with an opportunity to investigate a real-life problem using a multi-disciplinary approach. It also provided opportunities for mutual capacity building for staff from three universities.

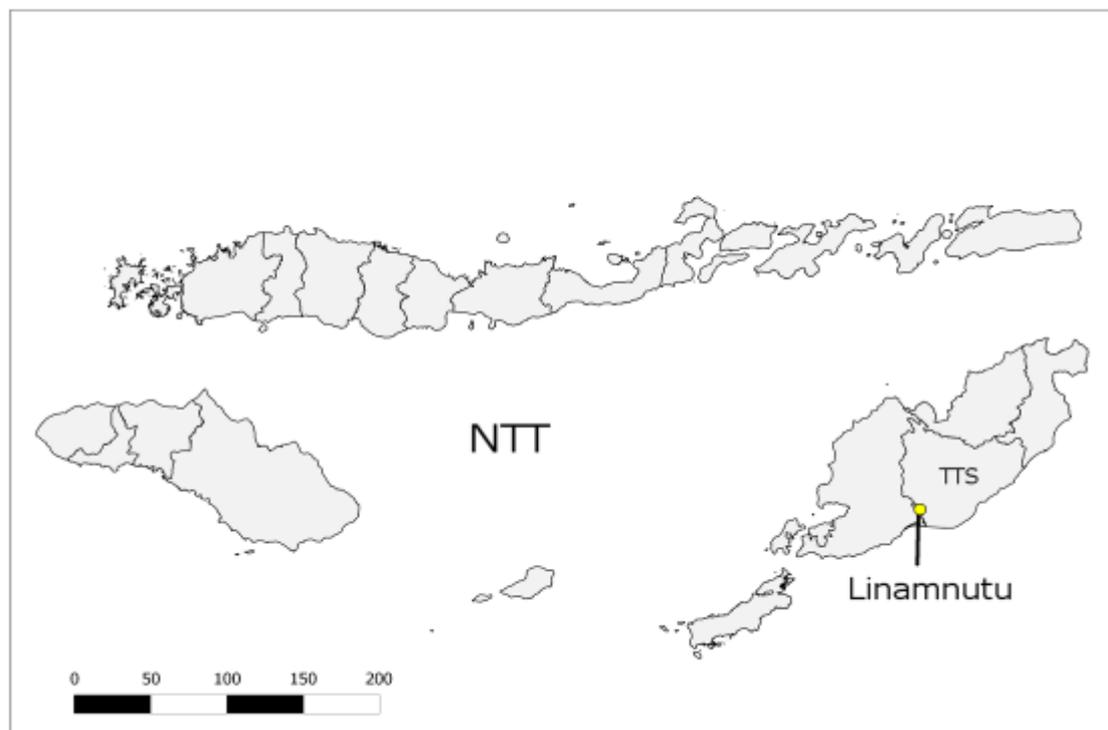
Capacity building and a contribution to rural development were implicit in the design of this activity.

Linamnutu was chosen as the site for this activity because of cultural connections between the staff from UNDANA and the local people, collaborative relationships between staff of the three universities and the local government of TTS, and the existence of suitable accommodation facilities in the village for the large research team.

## 2. Methods

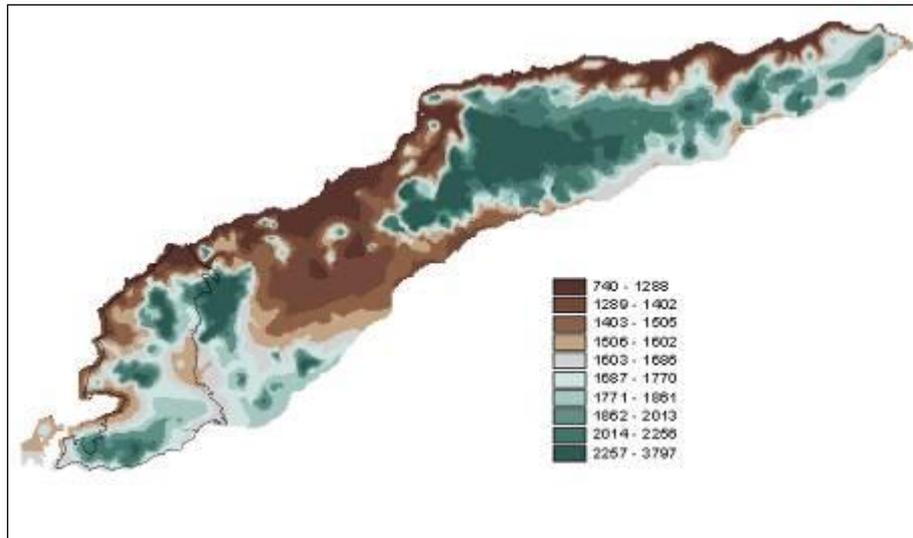
### 2.1 Study site

The study was conducted on west Timor, in Linamnutu village (N 8889341.17580, S 629273.91361), located at the lower end of the Noelmina River catchment in the District (*Kabupaten*) of Timor Tengah Selatan (TTS), in the province of Nusa Tenggara Timur (NTT) (Fig. 1).



**Figure 1.** Location of Linamnutu Village, Timor Tengah Selatan (TTS), in Nusa Tenggara Timur (NTT), Indonesia.

NTT has a monsoonal wet-dry tropical climate and is one of the driest provinces of Indonesia, with some areas frequently experiencing droughts and famine. The rainfall, and therefore the reliability of water resources, varies across west Timor. The southern coastal area has relatively higher rainfall (Fig. 2).



**Figure 2.** The distribution of rain over Timor Island as derived from modeled data (Santika 2004). (Image provided by Rohan Fisher.)

Linamnutu Village comprises three sub-villages or hamlets (*dusun*): Oetaman, Hausanuf and Linamnutu. As is often the case, the *dusun* are naturally-occurring units separated geographically (Bebbington *et al.* 2006). Within the *dusun* there are a total of nine neighbourhood units or RW (*rumah warga* or community solidarity units) which are in turn divided into a total of 20 RT (*rukun tetangga* or neighbour solidarity units).

## 2.2 Household interviews

### Community consultations

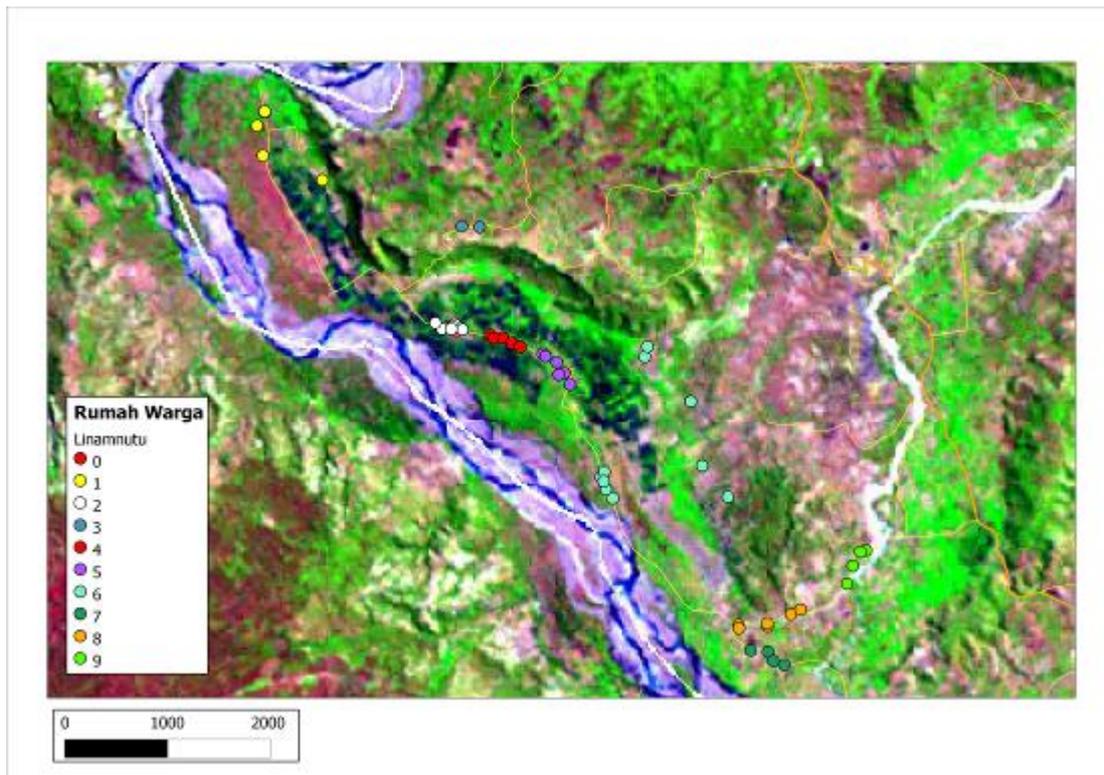
University research team members visited Linamnutu to discuss the proposed field activities with the village administration three months before the field study. UNDANA researchers discussed the proposed research in *Dawan* language.

Before the householder interviews, each household received an explanation of the purpose of the study and assurances that their participation was only voluntary and could be stopped at any stage without penalty and that their responses would be kept confidential and anonymous. These methods were approved by the Charles Darwin University Human Research Ethics Committee (#H09082). Copies of the project summary sheet and consent forms are presented in Appendix 1.

### Selection of interviewee households

Households were selected using stratified random sampling, to ensure adequate representation of sub-villages and topographic locations (Fig. 3). The Head of Linamnutu village and UNDANA researchers selected the households to be visited for interviews. A total of 59 households were interviewed: from 12 RT distributed in approximately equal numbers across all of the nine RW and three sub-villages. The food groups sampled households in six RT in six RW in all three sub-villages, and the water groups sampled households in eight RT in eight RW in all three sub-villages.

Villagers were engaged as guides to escort the researchers to the households to be interviewed, but did not take part in the interviews in order to protect the privacy of interviewees.



**Figure 3.** Location of all 59 house holds interviewed about either food or water, in each Rumah Warga (RW), within Linamnutu Village.

### Interviewers

Each household was interviewed by a group comprising a staff member and 5-6 students from the partner universities. This group included interpreters with skills in English, Indonesian and/or *Dawan*. In some cases one interpreter had skills in all three languages, and in other cases, an interpreter for English to Indonesian and another for Indonesian to *Dawan* participated. There was a total of 6 groups of interviewers.

### Interview type

Interviews were undertaken using standardised, open ended interview techniques (Patton 2002). Half of the interviewing groups addressed food security issues and half addressed water issues.

The interview questions related to food security were loosely based on the survey questions for assessing food security listed by Usfar (2007). The interview questions used in the present study sought to investigate the topics listed below.

1. Staple food, i.e. rice and/or maize, and other foods grown and eaten.
2. Number of meals eaten per day, and whether children and adults have the same diet.
3. Whether food shortage are experienced, and if so, when was the last time and cause of food shortage, and if the household was worried about nutrition.
4. Source of staple food grown and bought; the % of the harvest kept or sold.
5. Is average harvest enough for one year?
6. Agricultural practices - wetland/dryland; who works in field; is there cooperation with other farmers/ what methods of land preparation are used?
7. Is the householder a member of a farmer group?
8. Household land ownership - lease/own/share farm?

9. Animals - kept/sold?
10. Paid for off-farm work? How often?
11. Government support during food shortage?

The interview questions related to water access and management issues sought to investigate the topics listed below.

1. Sources of water e.g. well, rainfall, river, irrigation, soaks
2. Number of months that water is available from these sources
3. Uses of water from various sources, e.g. washing, drinking, livestock, *kebun* (garden or plantation), *padi* (rice field)
4. Frequency of water collection
5. Methods of water collection e.g. by foot, cart, motor bike
6. The management arrangements for irrigation water

### **2.3 Mapping methods – households and water sources**

Locations of houses where interviews were conducted and of the wells to which these households had access were recorded using GPS units. These locations were mapped using free software, QGIS.

Maps were created to highlight correlations between various characteristics recorded for the households.

### 3. Results

#### 3.1 General

Most (86%) householders were Timorese, with other ethnicities including five Rotenese, one Floresian and two Sabunese. Households had an average of 4.4 members with usually two members of the household under 12 years.

All households were headed by farmers, except for one headed by a midwife. Some (19%) of households included farmers who also had other paid work (e.g. public servant, labourer and grazier).

Only one household did not have tenure over their house garden and only three households had no tenure over farming land. Most (57%) households had tenure over some irrigated land, with about half of these also having tenure over non-irrigated land (Fig. 4, Fig. 5). About a third (36%) of households had tenure over non-irrigated land but no irrigated land.

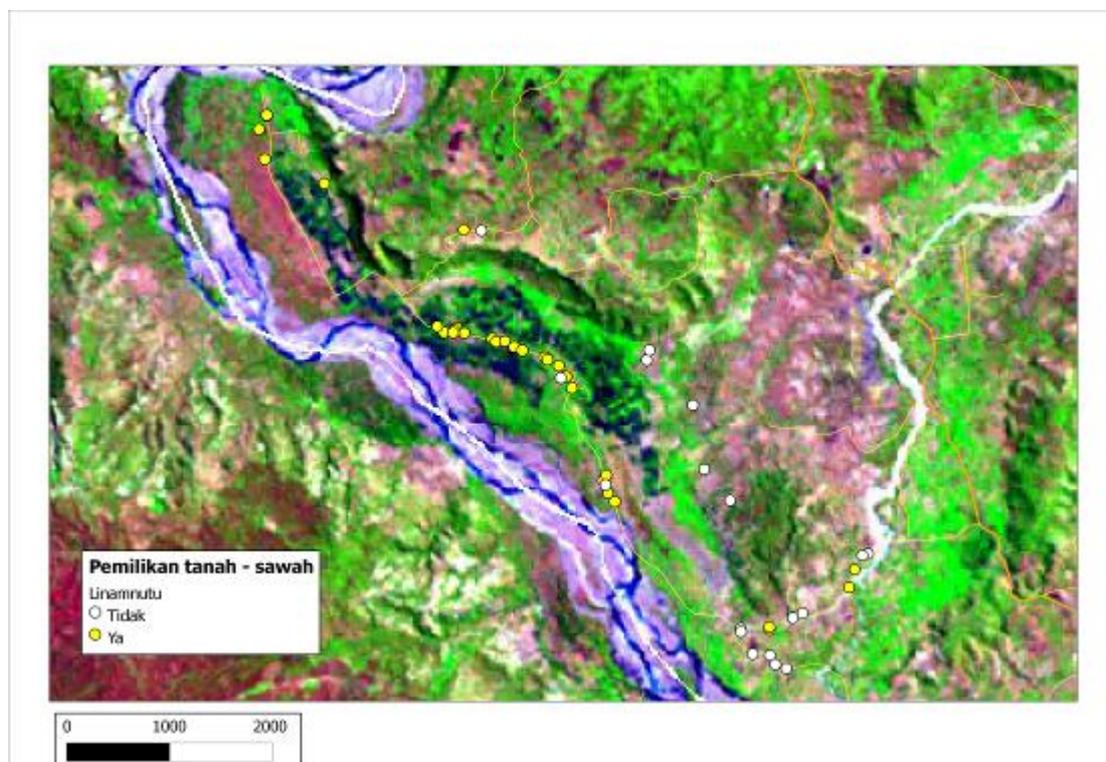


Figure 4. Household tenure in paddy fields, in Linamnutu Village.

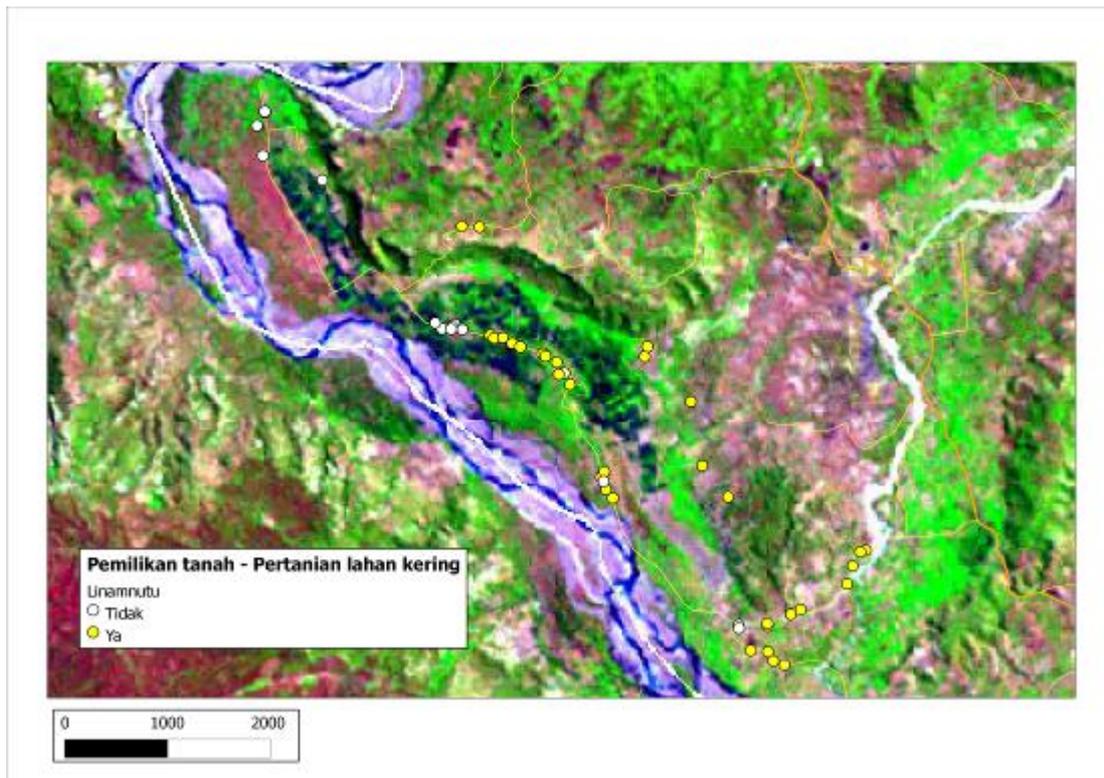


Figure 5. Household dryland tenure, Linamnutu Village (*Tidak* = no; *Ya* = yes).

The average area of tenure types (for those households with tenure) is shown in Table 1.

Table 1. Average area (in *are*; 1 *are* = 100 square metres) of tenured land, irrigated, non-irrigated and domestic garden for those respondents with tenure over these land types.

Non-irrigated land ( <i>are</i> )	Irrigated land ( <i>are</i> )	Domestic garden ( <i>are</i> )
0.78	0.94	0.76

### 3.2 Food

#### Types of food grown

Most (71%) households had both rice and maize as staple foods, with few (five) having only rice and (three) having only maize as staple foods (Fig. 6).

Most households grow rather than buy their staple foods. All households consumed rice, most (71%) growing rice and some also buying rice, with one household receiving rice as payment for labour in rice field. The data indicates that rice is also eaten by households where it is not considered a staple. All households grew maize and no households indicated that they bought maize.



**Figure 6.** The staple food for each household, of those interviewed about food resources, in Linamnutu Village.

A total of 19 vegetables and 9 fruit were grown in village gardens (Table 2).

**Table 2:** Vegetables and fruit consumed by households in the upland and lowland areas. Note the term fruit is used in a culinary, rather than botanical sense.

Lowland households		Upland households	
Vegetables	Fruit	Vegetables	Fruit
beans	avocado	banana flower	banana
cabbage	banana	cabbage	coconut
carrot	coconut	carrot	jackfruit
cassava	orange	cassava leaves, cassava	mango
chili	mango	choko	orange
Chinese cabbage	Papaya	jackfruit	papaya
choko	soursop	kangkung	soursop
eggplant		lettuce	
kangkung		marungga	
peanuts		nuts	
pumpkin		papaya flower	
sweet potato		papaya leaves	
		spinach	
		sweet potato	

Generally, meat was rarely consumed, with frequencies of consumption quoted from between once per month and four times per week, or only at festivals. In one household, meat was only for the children, but in most households children and adults had similar diets. Some households only ate meat when they had money available to buy it. Where meat was consumed, fish and chicken were the most common forms of meat consumed (Table 3).

**Table 3:** Percentage of households consuming other foods consumed.

Sources of animal protein consumed	Other foods
beef (11%)	salt
chicken (43%)	<i>putak</i> (fermented palm stalk)
egg (36%)	chili
fish (61%)	tempe
goat (3%)	tofu
pig (10%)	<i>lontar</i> (palm starch) with coconut when food short
tripe (3%)	coffee

Irrigated fields are mostly prepared using tractors, and non-irrigated fields are mostly prepared by fire and hoe (i.e. slash and burn). Some households reported a shortage of tractors, resulting in reduced production.

In most households, the men work in the fields, with the women also working in the fields in a third of households. Approximately a third of households work cooperatively with other farmers in their fields. Agricultural practices have changed in the past 2 years in half of the households, and three households report that their staple food has changed since the construction of the dam.

Land is leased for crop production by five of the 28 households interviewed about food, and about 20% of households have share-farming activities. About a third of farmers work for payment as well as working on their own land: two thirds do so only sometimes and a third do so always.

#### Food availability

Half the households interviewed had experienced food shortages. A similar proportion of households considered that an average harvest would be enough to supply staple food to their household for one year. Almost all households usually eat three meals per day, with three households eating two meals per day. Recollections of food shortages were most commonly about 2009 and these food shortages were attributed to “yellow” disease of rice, infestations of a stem-eating moth larva. One household described 2004 as a year of food shortage because no irrigation water was available during that year during the construction of the dam.

Subsistence agriculture is most common with harvest mostly for consumption by the household: only two households keeping half and selling half of their harvest, and another three households selling a little of the harvest or only when money was needed.

#### Coping with shortages

During interviews, individual households provided examples of strategies for coping with food shortages. For example, a Rotenese householder reported drinking *lontar* sap with coconut during times of food shortage. Other households reported selling animals or eggs during shortages of staples. One householder asked the interview group for advice on how to construct a nutritious and balanced diet for his family.

During householder interviews we were told that some members of the village community had sold land to free up cash to purchase food. These people then work as labourers on other people’s land to earn cash or receive a portion of the harvest as payment to secure household staples. Some interviewees saw this as a problem.

### Other issues raised

Although most (73%) of the households interviewed about food issues were satisfied with the irrigation system, only about half were satisfied with irrigation management.

The yellow disease (*hama kuning*), caused by a stem boring moth larvae, was reported as a major cause of reduced yields, and was sometimes reported as being associated with the initial influx of irrigation water. We had difficulty finding a householder who could describe the pest in detail, despite much concern about the effects, which may reflect a need for advice on pest management.

We found only 4 households were members of a farmers' collective (data on this was not consistently collected so is therefore incomplete). Some interviewees reported that a sample of farmers from Linamnutu had been sponsored to attend training workshops in places like Bali, but that this knowledge had not been effectively shared upon their return. Thus there appeared to be limited information-sharing among farmers.

### **3.3 Water**

#### Sources of water

Interviews indicated six sources of water - direct rainfall, river channels, stream-bed soaks, soaks at the base of slopes, wells and irrigation channels (Fig. 7). We also noted rainwater being collected from metal roofing and directed to plastic barrels in two houses, but these were not houses included in the interviews.

For all households, wells provided the primary source of year round drinking water, while in-channel soaks and river water were also used by some households (Table 4). Incidentally, some interviewees reported resorting to irrigation water, but only in extreme circumstances due to the associated health risks. Respondents indicated that direct rainfall was only ever used for garden and maize crops, and not for domestic purposes.

**Table 4.** Water sources and their use, as reported by households in Linamnutu. Values are the percentage of households reporting a particular use for each water source. Each value is a percentage of 30 households.

<b>Water source</b>	<b>Water use</b>					
	Drinking	Washing/bathing	Livestock	gardens	maize	Paddy fields
River water	100	96.7	80.0	13.3	-	-
In-channel soaks ( <i>oemata</i> )	10	10	0	0	-	-
Wells/slope-base soak ( <i>pancuran</i> )	100	96.7	80.0	13.3	-	-
Irrigation	0	23.3	16.7	16.7	-	96.7
Rainfall	0	0	0	100	96.7	-



(a) well (*sumur*)



(b) stream-bed soak (*oemata*)



(c) irrigation channels (*saluran irigasi*)

**Figure 7.** Examples of water source infrastructure used in Linamnutu Village. (a) well (*sumur*), (b) stream-bed soak (*oemata*) and (c) irrigation channels (*saluran irigasi*). Direct rainfall and river stream flow were also used.

#### Water availability

Householders reported that river water was available for between 4-6 months of the year, and was acquired for domestic use by walking, between once per day to once every second day, or by motor bike once every 4 days (one household).

Wells were accessed all year round in lowland households. However, some upland households reported wells there became saline or dry during the mid dry season and were unreliable (Fig. 8).



**Figure 8.** A well on an upland site that becomes saline and dries out during the annual dry season.

#### Water access

Access to each type of water source differed between upland and lowland households. Lowland households were generally close to wells. Households that owned a well shared this with between 1-6 other households (an average of 3 households per well). However, two households reported sharing wells with 30 and 32 households.

Wells were uncommon in upland households, and water was more commonly sourced from soaks lined with rocks at the base of upland slopes (*pancuran*). It is a steep climb between this water source and the surrounding households. Some passers-by reported visiting this water source up to 6 times a day to meet household needs (Fig. 9).



**Figure 9.** (a) A soak located at the foot of an upland slope (*pancuran*), used by many upland households. (b) Note the number of containers carried by the young water collector.

### Water quality

We were not able to systematically measure water quality, however preliminary ad hoc sampling of well water indicates that the physical properties are in accordance with drinking water standards. However some interviewees reported that during the rainy season well water is often dirty.

All householders reported boiling all water before drinking to avoid health problems.

### Management of irrigation water

Irrigation water is primarily used for rice growing, but is also used for washing clothes, bathing and, only in rare emergency situations, for drinking. Householders reported bathing in irrigation water consistently resulted in skin problems, and drinking irrigation water consistently resulted in illness.

The irrigation system is managed by the irrigation officers or *Petugas Pengelola dan Pembagian Air* (P3A). Water flow is controlled by a system of manual gates (Fig. 10). Only the P3A are allowed to open or close the gates.



**Figure 10.** An example of the gates used to control flow in the irrigation system at Linamnutu Village.

The P3A are elected by farmers to represent a certain area of land ownership, for a three year term. There appeared to be confusion among householders about how the P3A is paid - with interviewees reporting the following range of different responses when asked how the P3A were paid:

- 15 kg of rice harvest per 25m<sup>2</sup> of land owned by a farmer within the block (this is the most commonly reported payment method)
- 30%-50% of total rice harvest
- not paid at all
- paid by the government
- 60 kg of rice harvest per block

Even neighboring households would report different methods of remuneration for P3A.

For those who believed the P3A did receive payment, they reported a number of uses for that payment, namely:

- All for P3A personal use
- Divided between
  - ¼ for seed
  - ¼ for repairs and maintenance
  - ¼ for village needs (for example for visitors)
  - ¼ for the village barn
- Half for seed and half for repairs and maintenance

Many farmers were happy with the management of irrigation waters by their P3A. However some were not. Examples of complaints included:

- P3A was lazy or not serious
- A lack of technical skills meant the distribution of water was not even
- More water was provided to friends and family of P3A, or those who pay him “on the side”
- Those further away from gates receive less water
- Poor management of rubbish in channels, reducing flow
- If not well managed, the initial wet season water flow can result in many pest problems

When asked about options for actions they can take if they are not happy with a P3A, interviewees reported, that they can:

- Not pay
- Discuss it with the Village Head
- Wait for the next election
- Create a small committee to conduct investigations
- Talk to the P3A concerned
- Not do anything

Some farmers also reported that they had better access to water before the weir was built. Others reported being unable to farm during the two year period of construction of the weir.

## 4. Conclusions

Linamnutu is possibly more fortunate than other villages in TTS in that it is serviced by a weir and managed irrigation system. However, despite this massive government investment in infrastructure, access to food and water was more uneven among households than might be expected. For some interviewees, the dam has not improved, but may have worsened, access to irrigation water.

This patchiness in part appears to be related to unequal access to water resources including irrigation water and domestic water. Upland households in particular have less convenient access to domestic water and also to irrigation water.

Inconsistent management of irrigation water means that even those with access to irrigated land may not have satisfactory access to irrigation water. This may be due to poor technical skills or favoritism among P3A, in some blocks. (We also emphasise that many farmers are happy with the services of their P3A.)

Patchiness in access to food resources also occurs and appears to be due to the incidence of pests (in particular *hama kuning*) and knowledge of diet and nutrition.

Land tenure also varies between upland and lowland households. It is not known if change in tenure due to land sale is affecting household income or access to food resources in the longer term.

The study has uncovered training and information gaps within the village. Firstly, farmers are confused about the role and responsibilities of the P3A. P3A themselves in some cases lack skills to adequately manage water flow, and in some cases may not be distributing water equitably. There is scope for community education and training.

This study has uncovered some issues that would benefit from further investigation. Subsequent planning and data collection will be improved in future field trips through:

- Ongoing and further consultation with village community about priorities for future field studies, in order to ensure priority concerns are addressed
- Ongoing commitment to a community development model of research
- Inclusive selection of households for future interviews
- Improved preparation of interviewers
- Improved data management

Initial feed-back from village community members indicates that the role of research team as a communication tool or mediator between village perspective and agency staff has been useful.

## 5. Acknowledgements

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## **Appendix 1: Interview Consent Form and Project Summary sheet**

- Indonesian language versions were provided to households prior to interviews

### **Consent Form for**

**PROJECT TITLE:** Rural Development in Eastern Indonesia - Pilot Study

Please read this form, to see if you agree to take part.

I hereby consent to participate in a study designed by Dr Penny Wurm, Dr Bronwyn Myers, and Mr Sam Pickering of Charles Darwin University, Darwin, Dr Ferry Karwur and Mr Dharma Palekahelu of Satya Wacana Christian University, Salatiga, and Dr Gomer Liufeto and Mr Maximillian Kapa, of Nusa Cendana University, Kupang.

I understand that the purpose of the study is:

- To investigate (a) annual food cycles and shortages and (b) availability, access and quality of water resources in the village of Linamnutu.

This will help identify times when food and water resources are limiting for people. I understand these preliminary findings aim to assist in future food and water resources planning at Linamnutu.

I acknowledge that:

The aims, methods and anticipated benefits, and possible risks of the study, have been explained to me by the research team.

- I voluntarily and freely give my consent to my participation in this study
- That any information I provide will only be reported in summary descriptions about the village of Linamnutu, not as individual information
- Individual results will not be given to any person except at my request and on my authorisation
- I understand that aggregated results will be used for research purposes and may be reported in scientific journals and academic journals.
- I am free to withdraw my consent at any time during the study, in which event my participation in the research study will immediately cease, and any information obtained will be returned to me or destroyed at my request.

This information is provided to each person or household who volunteers to take part in the study.

Having now read this information, do you agree to be interviewed by the researchers?

If you are not happy at any stage with the way this study has been conducted, please lodge your complaint with any of the following, people.

- Charles Darwin University Ethics Officer on +61 1800 466 215

Or the following project team members:

- Dr Penny Wurm (CDU) on +61 419 854 147
- Dr Gomer Liufeto (UNDANA) on 0813 3925 0068
- Dr Ferry Karwur (UKSW) on 0813 2548 9390
- Mr John Asbano (BAPPEDA) on 0852 3948 9041

## PLAIN LANGUAGE STATEMENT

Project title: Rural Development in Eastern Indonesia - Pilot Study

Aims: To describe the water and food resources available in two sub-villages in Linamnutu, in order to provide tools (maps of water resources and descriptions of annual food availability) that may be used in future planning.

The project is run by UNDANA (Kupang), Satya Wacana Christian University (Salatiga), and Charles Darwin University (Darwin, Australia).

We will invite villagers and village heads in the village of Linamnutu, West Timor, to discuss the annual food cycle and water quality and access in the village. The research team will ask villagers to describe the crops grown, and other food resources available within the annual 12 month cycle. The research team will also map the location of water sources, and undertake a field assessment of water quality at each source.

Village members will be invited to consider the following questions.

1. What are the staple foods, and the sources of these foods?
2. When do food shortages occur: how often, what duration, which season?
3. What are the causes of food shortages (e.g. crop failure, deterioration of stored produce)?
4. What are the coping mechanisms used by households, communities, NGOs and governments for periods of food shortage?
5. How could food shortage be alleviated?
6. What are the sources and uses of water in the village and surrounding fields?
7. Are there problems with water supply in the village: quantity and/or quality, which season, how often?
8. Has water supply at the village changed over past years/decades according to locals' recollections and any official records?
9. What are the perceptions of causes of any changes in water supply, e.g. land use change in upper catchment, climate change?
10. What policies, regulations and traditional practices control water supply and water use?

The answers provided by participants will be recorded but they will be kept confidential. It will not be possible for other people to trace any comments to particular participants. The summarised findings of the research will be discussed in the field with participants at the end of the data collection period.

This information will help us to understand the current food and water resources and their availability. This information will be useful for villagers and agencies supporting them, when considering future planning issues such as additional or alternative crops and water resources management.

People who are invited to participate do not have to participate and they can decide to withdraw from the discussions at any time. The information from participants will be kept for 5 years and then destroyed.

You can get more information about the project by contacting:

- Dr Penny Wurm (CDU) on +61 419 854 147
- Dr Gomer Liufeto (UNDANA) on 0813 3925 0068
- Dr Ferry Karwur (UKSW) on 0813 2548 9390
- Mr John Asbano (BAPPEDA) on 0852 3948 9041

If you have any concerns about the project, you can call the CDU Ethics Toll Free telephone number 1800 466 215.